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A COMPARISON OF PRESESSION AND WITHIN-SESSION REINFORCEMENT CHOICE

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Single- and concurrent-operants procedures were used to evaluate the effects of two reinforcement conditions on the free-operant responding of 3 individuals with developmental disabilities and 1 with attention deficit disorder. In the presession choice condition, prior to each session the participant chose one item from an array of three different highly preferred stimuli. This item was delivered by the experimenter on each reinforcer delivery during that session. In the within-session choice condition, each reinforcer delivery consisted of placing an array of three different highly preferred stimuli in front of the participant, who was allowed to select one. Only one of the two reinforcement conditions was in effect for any particular session in single-operant phases. Buttons associated with each reinforcement condition were present, and the participant could allocate responses to one or the other in concurrent-operants phases. Data showed substantially more responding to the button associated with within-session choice than presession choice during concurrent-operants phases. This effect was not as apparent during single-operant phases, suggesting that a concurrent-operants procedure provided the more sensitive evaluation of within-session and presession reinforcer choice effects.

DESCRIPTORS: reinforcement, choice, developmental disabilities

Measuring the effects of choice on the behavior of persons with developmental disabilities has received much attention recently (e.g., Fisher & Mazur, 1997; Lancioni, O'Reilly, & Emerson, 1996). Providing choices has been shown to accurately identify reinforcing stimuli (DeLeon & Iwata, 1996; Fisher et al., 1992; Windsor, Piche, & Locke, 1994), improve task performance (Dunlap et al., 1994; Foster-Johnson, Ferro, & Dunlap, 1994; Mithaug & Mar, 1980; Parsons, Reid, Reynolds, & Bumgarner, 1990), and reduce challenging behaviors (Dyer, Dunlap, & Winterling, 1990; Peck et al., 1996; Vaughn & Horner, 1997). Providing the opportunity to make a choice appears to be an operation that can have a substantial effect on responding for some individuals. Only a few studies, however, have examined how often and in what manner choices should be provided for maximal benefits. Two methods for allowing individuals choice of reinforcer that have been reported in the literature are (a) presession choice of reinforcer, in which the participant selects a reinforcer prior to a session and then receives that item on each reinforcer delivery during

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the session; and (b) within-session choice of reinforcer, in which the individual chooses an item on each reinforcer delivery during the session.

One early experiment investigated the effects of presession choice of reinforcer on responding in subsequent teaching sessions (Mason, McGee, Farmer-Dougan, & Risley, 1989). During mini-assessments conducted immediately prior to each teaching session, participants were allowed to choose from arrays of stimuli previously identified in systematic reinforcer assessments as highly preferred. Items selected during each presession mini-assessment were delivered contingently on target responses in the teaching session. Although the authors found that allowing participants choice of highly preferred stimuli led to lower rates of challenging responses than using teacher-selected stimuli, they did not demonstrate that teacher-delivered stimuli actually functioned as reinforcers. Nonetheless, Mason et al. suggested that, in addition to systematic reinforcer assessments, providing choices prior to each teaching session may be beneficial, because preferences for stimuli may change over time.

One recent study used a concurrent-operants arrangement to investigate the effects of within-session choice on the responding of 3 individuals with mild to moderate developmental disabilities (Fisher, Thompson, Piazza, Crosland, & Gotjen, 1997). Stimulus preference assessments (Fisher et al., 1992) were used to generate a hierarchy of preferred stimuli for each participant. During Experiment 1, three microswitches were concurrently available to participants. One microswitch was associated with within-session choice, in which the participant could select one of two stimuli; a second microswitch was associated with experimenter-delivered reinforcement (no choice), with the schedule of reinforcer delivery yoked to the previous choice session; a third microswitch served as a control, with no programmed consequences. Stimuli were available on a variable-interval (VI) 15-s schedule or a VI 30-s schedule for pressing one of the microswitches. Three phases were conducted with each participant: a higher preference phase (HP), in which the top two ranked items from the preference assessment were used; a lower preference phase (LP), in which the bottom two ranked items were used; and an HP and LP phase, which contained one high-preference item and one low-preference item. Participants emitted more responses per minute to the microswitch correlated with within-session choice than to the microswitch correlated with experimenter-delivered reinforcement in all three phases, even though the same items were presented in the same order in both conditions. This suggested that the participants preferred within-session reinforcer choice over experimenter-delivered reinforcement.

For many individuals with developmental disabilities, within-session reinforcer choice is likely to be more effective than presession choice, for several reasons: (a) Within-session choice may accommodate momentary (within-session) fluctuations in reinforcer preference, (b) within-session choice permits stimulus variation during each session (as long as participants' choices vary), and (c) the opportunity to choose may be a reinforcer. Within-session reinforcer choice provides these opportunities contingent on responding, whereas presession choice procedures do not.

Although several studies have shown that allowing individuals with disabilities to make choices can have beneficial effects, other studies have not found such effects. One recent investigation of presession choice of reinforcer compared subject-selected versus experimenter-selected reinforcers in an alternating treatments design (Smith, Iwata, & Shore, 1995). Prior to each session, either the participant or the experimenter chose a stimulus to be delivered contingent upon re-

sponding. The authors found that allowing a participant to choose the reinforcer prior to a session led to no increment in response rate relative to experimenter-selected reinforcement. In a study using alternating treatments and reversal designs, Lerman et al. (1997) evaluated the effects of within-session choice on the free-operant response rates of 6 individuals with severe to profound mental retardation. In the choice condition, on each reinforcer delivery the participant was allowed to select the reinforcer from an array of two previously identified preferred stimuli. In the no-choice condition, the experimenter delivered the reinforcer, with the schedule of reinforcer delivery yoked to the previous choice condition. There was no difference in response rates between choice and no-choice conditions. The failure of these studies to find beneficial effects of choice may have been due to the use of single-operant procedures, which provided a less sensitive measure of preference than did the concurrent-operants arrangements. In addition, the use of a presession choice procedure (Smith et al., 1995) did not permit the benefits described in either (a) or (b) above.

Most experiments measuring the effects of choice on the responding of individuals with developmental disabilities have used either single-operant (alternating treatments) or concurrent-operants designs; few studies have used both arrangements within and across participants. In studies that used a single-operant arrangement (e.g., Lerman et al., 1997; Smith et al., 1995), it is difficult to determine whether there was no differential effect of participant choice or the methods were not sensitive enough to detect an effect. The purpose of the present experiment was to determine the relative effects of within-session and presession reinforcer choice within the context of both single- and concurrent-operants procedures. Yoking procedures were omitted to permit an assessment of stimulus variation.

METHOD

Participants, Setting, and Sessions

Three students with developmental disabilities and 1 with attention deficit disorder served as participants. All were enrolled in a residential school for students with autism, developmental disabilities, and behavior disorders. Geoff, an 11-year-old nonspeaking boy, had a diagnosis of pervasive developmental disorder and severe mental retardation. Bill was an 11-year-old boy with a limited verbal repertoire who had been diagnosed with autism and severe mental retardation. Steve was a 9-year-old verbal boy who had been diagnosed with pervasive developmental disorder and attention deficit disorder; his academic functioning was 2 years below grade level. Bob was a 7-year-old verbal boy who had been diagnosed with attention deficit disorder. A recently completed Weschler Preschool and Primary Scale of Intelligence (WPPSI-R) indicated that he functioned in the borderline range. All participants engaged in challenging behavior; however, these did not interfere with participation in the present study.

Sessions were conducted in an empty room during various hours of the school day. The room measured 4 m by 2 m, and contained few materials other than those required for the study. Each session lasted 10 min. Sessions occurred once or twice per day, with approximately 4 hr between sessions on days when two sessions occurred. Sessions typically occurred 4 or 5 days per week.

Preliminary Assessments

Participants were exposed to a stimulus preference assessment, using the procedures described by Fisher et al. (1992). For each participant, 16 edible and nonedible items were selected for the preference assessment, based upon the recommendations of the teaching staff. On each trial two stimuli were

randomly selected and placed in front of the participant. The position of the two items was random. They were placed approximately 0.3 m in front of the individual and 0.5 m apart. Approach responses were defined and recorded for all participants. The percentage of approach responses was calculated for each stimulus, and the three stimuli with the highest percentage of approach responses were selected for inclusion in this study. For Geoff, these items were gumdrops, Skittles®, and soda; for Bill, soda, potato chips, and chocolate chip cookies; for Steve, brownies, potato chips, and soda; and for Bob, Doritos®, brownies, and soda.

Each reinforcement condition was associated with a different color background on the work table and a different colored button. Therefore, pretests were conducted to determine if the students could discriminate the experimental colors. Three cards (5.1 cm by 7.6 cm) colored blue, yellow, and red were placed in front of the participant. Cards of one of the three colors were given to the participant one at a time, and he was required to sort the cards by placing cards of identical colors on top of one another. No reinforcers were delivered for correct responses. When the participant sorted 20 cards with at least 90% accuracy, he was considered to have met the criterion for color discrimination. All participants met the criterion in one pretest session.

Task

The task was a free-operant button press. This task was selected because it was comparable to the kinds of tasks employed in other investigations of the effects of reinforcer choice with similar participants (e.g., Fisher et al., 1997; Lerman et al., 1997). Geoff, Bill, and Steve had previous experience with the task. Bob learned the task and met the terminal response requirement during the first session. For all participants, the reinforcement schedule to start was fixed-ratio (FR) 1, which was gradually thinned within that session. The reinforcement schedules achieved at the end of the first session (FR 60 for Geoff and Steve and FR 50 for Bill and Bob) were used in subsequent sessions as the terminal response requirements. When the schedule requirement was met, the experimenter used a clicker to signal the availability of reinforcement. In general, participants stopped responding when the audible click was delivered, and resumed responding after the reinforcer was consumed. Response rates were not corrected by subtracting the period of reinforcer delivery and consumption. Participants were allowed access to as many reinforcers as they could earn in each 10-min session.

Design and Experimental Conditions

A combined single-operant (alternating treatments) and concurrent-operants design with three phases was used. Two of the participants experienced the phases in ABCBC order; the order for the other 2 participants was ACBCB.

Phase A: Baseline. A condition in which button pressing had no consequences was conducted as a baseline against which to determine whether the stimuli selected in the preference assessment functioned as reinforcers. At the beginning of each baseline session, a large (0.6 m by 1 m) piece of yellow cardboard was placed on the table. A yellow response button was placed on the cardboard in front of the participant, who was instructed to "Press the button." No programmed consequences were provided for pressing the yellow button.

Phase B: Single operant. Two experimental conditions were used in the single-operant phase. In the presession choice condition, immediately prior to each session, an array of three stimuli (those selected at the highest percentages on the preference assessment) was placed approximately 0.3 m in front of the participant. Stimuli were approximately

0.2 m apart. The positions of the stimuli were counterbalanced across trials. The participant was instructed to "Choose one." The first stimulus the participant approached was presented on each reinforcer delivery during the upcoming session. At the start of the session, a large (0.6 m by 1 m) piece of blue cardboard was placed on the table. A blue response button was placed on the cardboard in front of the participant, and an array of three identical stimuli was placed directly behind the response button (e.g., cups each containing 5 cc of soda, three potato chips of similar size, etc.). The experimenter verbally instructed the participant to "Begin." Each reinforcer delivery consisted of the experimenter handing one of the three stimuli to the participant. After an item was delivered to the participant, another identical item was added to the stimulus array behind the response button. Any further attempts to obtain items were blocked by the experimenter.

The within-session choice condition was color-coded with red cardboard, and a red response button was placed on the cardboard. An array of three different edible items was placed directly behind the response button. On each reinforcer delivery the participant picked up one of the three items. Attempts to obtain an item before the audible click or after one item had been selected were blocked by the experimenter. After an item was selected by the participant, another identical item was added to the stimulus array behind the response button. The position of the three items was counterbalanced across reinforcer deliveries.

Phase C: Concurrent operants. In this phase, the presession and within-session choice conditions were available concurrently. Immediately prior to each session, an array of three stimuli was placed in front of the participant. The participant was instructed to "Choose one." The first stimulus the participant approached was presented on each reinforcer delivery during the upcoming session for responding on the blue button (presession choice). All three stimuli were available for responding on the red button; the participant selected one on each reinforcer delivery (within-session choice). Red cardboard was placed on half the table, and the red response button was placed on it; blue cardboard was placed on the other half of the table, with the blue response button on it. An array of three edible items was placed directly behind each response button, corresponding to what was available for pressing each button. The positions of the cardboard and buttons were randomized from session to session, with the stipulation that the positions remained the same for no more than two consecutive sessions. To start the session, the participant was instructed to "Begin," and could allocate responses to either button. When the red button was pressed, the participant could select the edible item on an FR 50 or FR 60 schedule after the experimenter delivered an audible click; when the blue button was pressed, the experimenter delivered the edible item selected before the session by the participant on an FR 50 or FR 60 schedule after delivering the audible click. Attempts to obtain items before the click had been sounded or after one item was selected or delivered were blocked by the experimenter.

Criteria for Phase Changes

Initially, the criteria for changing between Phases B and C required participants to display differential responding between conditions as well as stability in responding in both conditions. However, when these criteria proved difficult to apply with the 1st participant (Geoff) during the first single-operant phase, the criteria were changed. The new criteria required a difference of greater than 30 responses per minute between conditions for three consecutive sessions, or a difference of fewer than five re-

sponses per minute between conditions for three consecutive sessions.

Response Measurement and Interobserver Agreement

Dependent variables were free-operant response rate and stimulus consumption. *Free-operant response rate* was defined as the number of free-operant responses emitted during the session. This was converted to the number of responses per minute (rate). Each button was connected to an automatic counter, which recorded the number of button presses. *Stimulus consumption* was defined as the frequency and type of stimuli consumed by the participant. The experimenter recorded the stimulus consumed on each reinforcer delivery using paper and pencil.

A second observer was present and recorded data on the two dependent variables in an average of 44% of sessions, across all experimental phases. The second observer independently recorded the number of free-operant responses (by writing down the number of responses recorded by the automatic counter) and recorded the stimulus consumed on each reinforcer delivery. For number of responses, an agreement occurred when both observers wrote down the same number of responses from the automatic counter; experimenter–observer agreement was calculated by dividing the smaller number by the larger number and multiplying by 100%. For stimulus consumption, each reinforcer delivery was designated a trial. An agreement was defined as both observers recording the same stimulus consumed on a trial; a disagreement was scored when the observers recorded different stimuli being consumed on a trial. Experimenter–observer agreement was calculated on a trial-by-trial basis, by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100%. For Geoff, a second observer recorded data in 47% of sessions. Mean agreement was 100% for the number of responses and for stimulus consumption. For Bill, a second observer recorded data in 39% of sessions. Mean agreement was 100% for the number of responses and 99% (range, 89% to 100%) for stimulus consumption. For Steve, a second observer recorded data in 46% of sessions. Mean agreement was 100% for the number of responses and 99% (range, 95% to 100%) for stimulus consumption. For Bob, a second observer recorded data in 45% of sessions. Mean agreement was 100% for the number of responses and for stimulus consumption.

RESULTS

Figure 1 (top panel) depicts the results for Geoff. Baseline response rates were low and stable. At the onset of the first concurrent-operants phase, there was an immediate change in the level of responding to the button associated with within-session choice but not to the button associated with presession choice. Response rates in the within-session choice condition were variable but substantially higher than in baseline and in presession choice conditions, in which rates were similar. During the first single-operant phase, there was no clear difference in response rate between reinforcement conditions for the first 12 sessions, and no trends were evident in either condition. However, after that point, differential responding began to emerge. Increasing trends were evident in both conditions throughout the remainder of this phase, but rates were always higher in the within-session choice condition than in the presession choice condition. Across sessions in the second concurrent-operants phase, there was an overall decreasing trend in the data from the within-session choice condition, but with one exception, response rates were substantially higher than in the presession choice condition. Throughout the second single-operant phase, re-

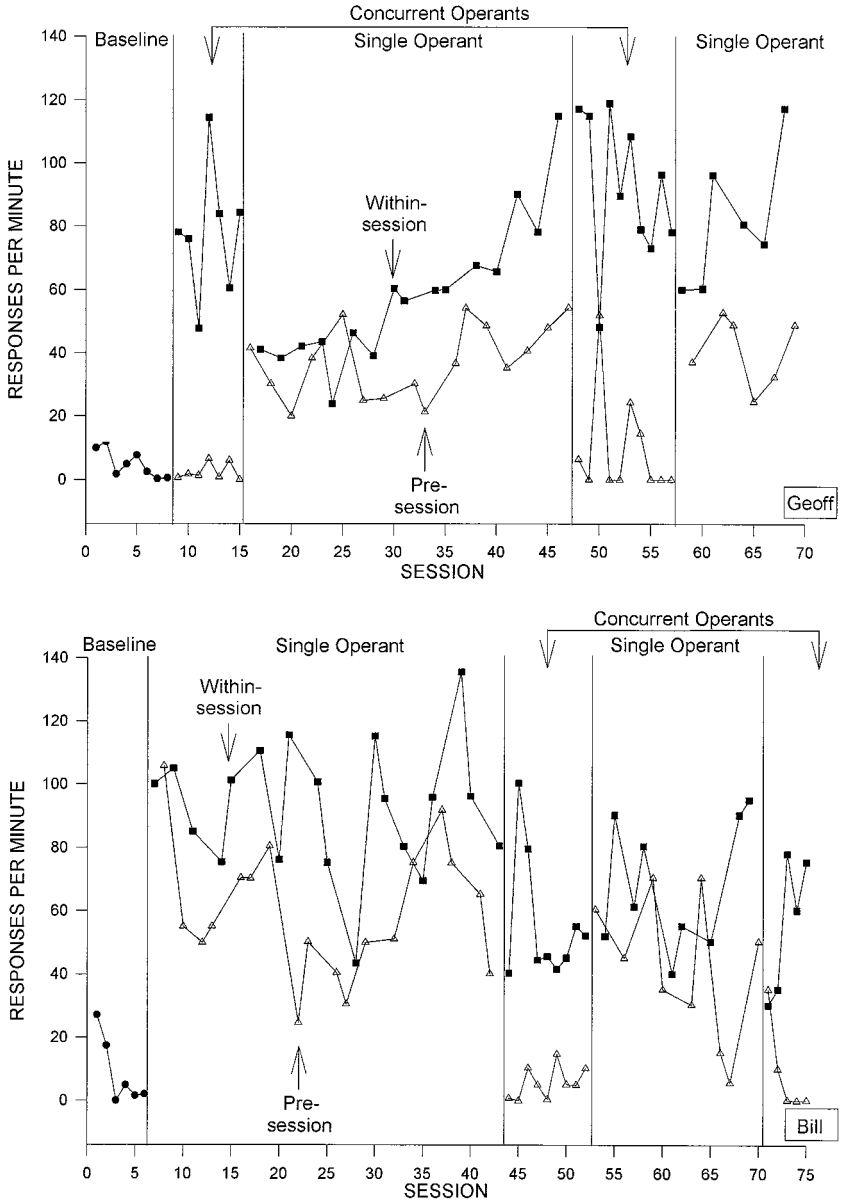

Figure 1. Response rates across sessions for Geoff and Bill.

sponse rates were higher in the within-session choice condition than in the presession choice condition.

Results for Bill are shown in the bottom panel of Figure 1. During baseline, responding quickly stabilized at near-zero rates. Throughout the first single-operant phase, responding was variable in both conditions; however, the overall mean response rate was higher in the within-session condition than in the presession choice condition (92.5 vs. 60.1 responses per minute). During the first concurrent-operants phase, responding in the presession choice condition was near baseline level; the response rate was substantially higher in the within-session choice condition. Response rates were relatively stable in both conditions during the final six

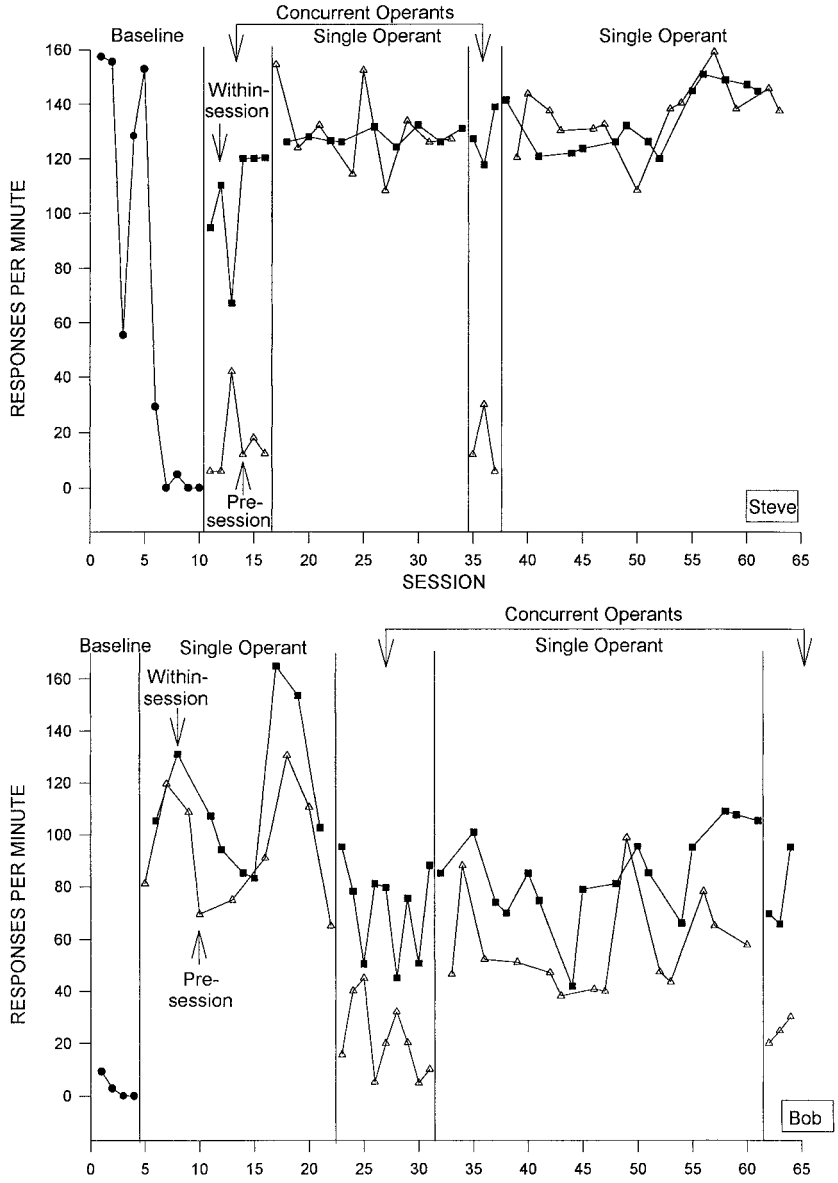

Figure 2. Response rates across sessions for Steve and Bob.

sessions in this phase. During the second single-operant phase, responding in both conditions showed high degrees of variability; however, response rate tended to decrease across presession choice sessions. Overall, Bill emitted more responses per minute in the within-session choice condition (M = 68.5) than in the presession choice condition (M = 42.5) during this phase. A return to the concurrent-operants phase again produced clear and consistent differential effects after the first session, with responding in the presession choice condition decreasing rapidly to zero, whereas rates in the within-session choice condition were relatively high.

Steve's data are shown in Figure 2 (top panel). Initial baseline response rates were

high, but dropped abruptly and stabilized near zero. The first concurrent-operants phase produced an immediate sharp increase in the level of responding on the within-session choice button but not on the presession choice button. Rates remained clearly differentiated throughout this phase, and stabilized from the fourth session on. During the first single-operant phase, responding in both conditions was relatively stable, and no consistent differences were noted across sessions. Steve's mean response rate was 127.9 per minute in the within-session choice condition and 130.2 per minute in the presession choice condition. In the second concurrent-operants phase, rates of responding on the within-session choice button were high and stable, and responding on the presession choice button occurred at low rates. In the second single-operant phase, no clear and consistent difference in response rate was noted. Overall, Steve's mean response rate was 134.3 per minute in the within-session choice condition and 135.4 per minute in the presession choice condition.

Figure 2 (bottom panel) depicts the data for Bob. His baseline response rate was low. During the first single-operant phase, rates of responding on both buttons were fairly high but variable, with a mean of 114.1 responses per minute in the within-session choice condition and 96.3 responses per minute in the presession choice condition. During the first concurrent-operants phase, variability was evident in both conditions, but more responding occurred on the within-session choice button than on the presession choice button in every session. This pattern continued throughout most of the second single-operant phase. When the concurrent-operants procedure was reintroduced, there was a clear differentiation in response rates. Rates were higher in the within-session choice condition than in the presession choice condition.

Data on stimulus consumption are presented in Table 1. These data indicate how much participant-controlled stimulus variation occurred in the within-session choice condition and across sessions in the presession choice condition, by experimental phases. Geoff's selections were variable in the within-session choice condition initially, but across subsequent phases, variation decreased until he was selecting one item almost exclusively. Little stimulus variation occurred in presession conditions in any experimental phase. Bill's selections varied frequently in all within-session choice conditions. His selections varied in the presession choice condition in the first single-operant phase, but across subsequent phases, variation decreased in this condition. Steve's selections varied frequently in all within-session choice conditions. During some phases selections varied in the presession choice condition; in other phases, little or no stimulus variation occurred in the presession choice condition. Bob's selections varied in both the within-session and presession conditions in all phases.

DISCUSSION

For participants in this study, providing within-session choice enhanced performance relative to presession choice, and this effect was more apparent when the two reinforcement conditions were available concurrently. During single-operant phases, several different patterns of responding were evident across participants. Steve showed no difference in responding under the two reinforcement conditions. Geoff showed no difference in responding during the first 12 sessions in the first single-operant phase; after that, consistent differences in response rates were seen in the two conditions. In single-operant alternating treatment designs in which conditions are presented successively, establishing discriminative control over the responding of participants with severe dis-

Table 1
Mean Percentages of Preferred Stimuli Consumed Across Reinforcement Opportunities by Phase and Condition for Each Participant

Participant	Stimulus	Within session	Presession	Within session	Presession	Within session	Presession	Within session	Presession
		Concurrent		Single		Concurrent		Single	
Geoff		Operants 1		Operant 1		Operants 2		Operant 2	
	Soda	28.9	0	41.7	0	28.2	0	6.3	0
	Skittle	43.3	0	54.9	93.7	69.1	100	93.7	100
	Gumdrop	27.8	100	3.5	6.3	2.7	0	0	0
		Single		Concurrent		Single		Concurrent	
Bill		Operant 1		Operants 1		Operant 2		Operants 2	
	Chips	56.4	47.7	49.5	10.0	51.7	0	54.5	0
	Soda	28.4	28.2	19.2	20.0	16.7	13.2	10.9	100
	Cookie	15.2	24.1	31.3	70.0	31.7	86.8	34.5	0
		Concurrent		Single		Concurrent		Single	
Steve		Operants 1		Operant 1		Operants 2		Operant 2	
	Chips	30.1	0	31.4	37.5	52.4	59.3	57.3	80.2
	Brownie	58.3	0	24.1	62.5	25.4	10.8	6.3	0
	Soda	11.7	100	44.5	0	22.2	30.0	36.5	19.8
		Single		Concurrent		Single		Concurrent	
Bob		Operant 1		Operants 1		Operant 2		Operants 2	
	Soda	50.5	47.7	53.6	28.9	31.6	42.5	20.0	0
	Dorito	23.3	28.2	24.0	13.2	41.4	45.8	48.9	73.3
	Brownie	26.2	24.1	22.4	57.9	27.0	11.8	31.1	26.7

abilities may be particularly difficult; thus, differences in responding may not appear until participants have been exposed to enough sessions to acquire the discrimination (Barlow & Hersen, 1984; Sidman, 1960). This may have occurred with Geoff. Bill and Bob emitted more responses in the within-session choice condition than in the presession choice condition in single-operant phases. Both displayed high rates of variability across sessions, and on some days emitted more responses in the presession condition than in the within-session choice condition. During concurrent-operants phases, on the other hand, all participants emitted more responses on the button associated with within-session choice. These findings are consistent with the results of other investigations using concurrent-operants procedures (e.g., Brigham & Sherman, 1973; Fisher et al., 1997). The participation of individuals with different functioning levels (Steve and Bob had less severe disabilities than Geoff and Bill) may increase the external validity of these findings.

There are several potential explanations for these results. One is that stimulus variation, rather than the opportunity to make choices within a session, might be responsible for the higher response rates in the within-session choice condition. One of the benefits of within-session choice is that it allows participants to receive a variety of reinforcers during a session. By contrast, in presession choice conditions, the same stimulus is presented on each reinforcer delivery. Previous studies have demonstrated that varying edible reinforcers produced more time on task and slower satiation than keeping reinforcers constant (Egel, 1980, 1981) and that some individuals with developmental disabilities preferred varied stimuli of slightly lower quality over constant stimuli of higher quality (Bowman, Piazza, Fisher, Hagopian, & Kogan, 1997). In this study, within-session and presession choice were confounded with

varied and constant reinforcers, respectively. The data in Table 1, however, shed some light on the role of stimulus variation in this experiment. These data summarize the extent to which our participants' selections varied across reinforcer deliveries in the within-session choice condition and across sessions in the presession choice condition. Geoff's selections tended to vary in the within-session condition but not in the presession choice condition in all phases except the final single-operant phase, in which he selected one stimulus (Skittles®) almost exclusively in both conditions. Bill's stimulus selections tended to vary both within session and presession in all cases except the presession condition in the final concurrent-operants phase. Steve showed a similar pattern of varied stimulus selections in all but the presession condition in the first concurrent-operants phase. Bob's selections varied in both conditions in all phases. In summary, although some participants' selections varied across presession choice conditions, within each session in that condition the same item was delivered on every reinforcement opportunity. The within-session choice condition, on the other hand, permitted stimulus variation within each session. Taken together, the data in Table 1 support the hypothesis that the differential effects of within-session choice obtained in this experiment may have been due to stimulus variation. This is a post hoc interpretation, however. Future research could use yoking procedures to evaluate whether results obtained in within-session choice sessions would be similar if stimuli were simply varied (e.g., Fisher et al., 1997).

A second possible explanation for enhanced performance in within-session choice conditions involves momentary fluctuations in reinforcer effectiveness. It has been demonstrated that preferences for reinforcers change over time (Mason et al., 1989). The within-session choice condition may have better accommodated short-term fluctuations in reinforcer preferences by allowing participants to select the stimulus that was most preferred at each reinforcer delivery. In addition, the repeated consumption of single reinforcers during the presession choice condition may have altered within-session establishing operations. For example, when Bill consumed potato chips repeatedly in a presession choice session, that may have functioned as an establishing operation to decrease the effectiveness of potato chips as a reinforcer as the session progressed. This hypothesis could be tested by delivering conditioned reinforcers (e.g., red or blue tokens) during sessions that could be exchanged for reinforcers after the session. Because no edible items would be consumed during a session, within-session establishing operations would not be altered.

Many individuals with severe to profound mental retardation have difficulty learning discriminations (e.g., McIlvane & Stoddard, 1981; Saunders & Spradlin, 1989). During single-operant phases of this study, participants were required to discriminate conditions presented successively with long intervals (at least 4 hr) between presentations. The concurrent-operants arrangement, on the other hand, called for a simultaneous discrimination between conditions. Individuals with mental retardation often require special teaching procedures to acquire successive discriminations, even when the events to be discriminated are presented in close temporal contiguity (e.g., sample stimuli on successive match-to-sample trials). The same individuals have relatively less difficulty learning to discriminate simultaneously presented events (e.g., comparison stimuli on match-to-sample trials; Saunders & Spradlin, 1989; Zygmont, Lazar, Dube, & McIlvane, 1992). Thus, the differential sensitivity of the single- and concurrent-operants procedures to the effects of different reinforcement conditions may be due in part to differential discrimination demands. In

this study, distinctive stimuli were associated with each reinforcement condition, including the presence of the reinforcers directly behind the button. It is possible that the more distinct the conditions are, the more likely the participant will attend to and discriminate the differences (cf. Dinsmoor, 1985; Soraci, Deckner, Baumeister, & Carlin, 1990). The present investigation, however, did not include a systematic, independent analysis of the discriminability of each reinforcement condition. Future research should investigate the role of discrimination difficulties in assessing choice in individuals with severe disabilities.

Presession reinforcer choice (by the participant) has been advocated as part of a comprehensive assessment of reinforcers for individuals with disabilities (Mason et al., 1989). For our participants, within-session choice proved to be superior to presession choice. The external validity of the present study is limited, however, due to the nature of the task, a simple free operant. Future research should explore whether the within-session choice manipulation yields similar results with more complex and more clinically significant tasks.

REFERENCES

Barlow, D. H., & Hersen, M. (1984). *Single case experimental designs: Strategies for studying behavior change* (2nd ed.). New York: Pergamon Press.

Bowman, L. G., Piazza, C. C., Fisher, W. W., Hagopian, L. P., & Kogan, J. S. (1997). Assessment of preference for varied versus constant reinforcers. *Journal of Applied Behavior Analysis, 30,* 451–458.

Brigham, T. A., & Sherman, J. A. (1973). Effects of choice and immediacy of reinforcement on single response and switching behavior of children. *Journal of the Experimental Analysis of Behavior, 19,* 425–435.

DeLeon, I. G., & Iwata, B. A. (1996). Evaluation of a multiple-stimulus presentation format for assessing reinforcer preferences. *Journal of Applied Behavior Analysis, 29,* 519–533.

Dinsmoor, J. A. (1985). The role of observing and attention in establishing stimulus control. *Journal of the Experimental Analysis of Behavior, 43,* 365–381.

Dunlap, G., DePerzel, M., Clarke, S., Wilson, D., Write, S., White, R., & Gomez, A. (1994). Choice making to promote adaptive behavior for students with emotional and behavioral challenges. *Journal of Applied Behavior Analysis, 27,* 505–518.

Dyer, K., Dunlap, G., & Winterling, V. (1990). Effects of choice making on the serious problem behaviors of students with severe handicaps. *Journal of Applied Behavior Analysis, 23,* 515–524.

Egel, A. L. (1980). The effects of constant vs. varied reinforcer presentation on responding by autistic children. *Journal of Experimental Child Psychology, 30,* 455–463.

Egel, A. L. (1981). Reinforcer variation: Implications for motivating developmentally disabled children. *Journal of Applied Behavior Analysis, 14,* 345–350.

Fisher, W. W., & Mazur, J. E. (1997). Basic and applied research on choice responding. *Journal of Applied Behavior Analysis, 30,* 387–410.

Fisher, W., Piazza, C. C., Bowman, L. G., Hagopian, L. P., Owens, J. C., & Slevin, I. (1992). A comparison of two approaches for identifying reinforcers for persons with severe and profound disabilities. *Journal of Applied Behavior Analysis, 25,* 491–498.

Fisher, W. W., Thompson, R. H., Piazza, C. C., Crosland, K., & Gotjen, D. (1997). On the relative reinforcing effects of choice and differential consequences. *Journal of Applied Behavior Analysis, 30,* 423–438.

Foster-Johnson, L., Ferro, J., & Dunlap, G. (1994). Preferred curricular activities and reduced problem behaviors in students with intellectual disabilities. *Journal of Applied Behavior Analysis, 27,* 493–504.

Lancioni, G. E., O'Reilly, M. F., & Emerson, E. (1996). A review of choice research with people with severe and profound developmental disabilities. *Research in Developmental Disabilities, 17,* 391–411.

Lerman, D. C., Iwata, B. A., Rainville, B., Adelinis, J. D., Crosland, K., & Kogan, J. (1997). Effects of reinforcement choice on task responding in individuals with developmental disabilities. *Journal of Applied Behavior Analysis, 30,* 411–422.

Mason, S. A., McGee, G. G., Farmer-Dougan, V., & Risley, T. R. (1989). A practical strategy for ongoing reinforcer assessment. *Journal of Applied Behavior Analysis, 22,* 171–179.

McIlvane, W. J., & Stoddard, L. T. (1981). Acquisition of matching-to-sample performances in severe retardation: Learning by exclusion. *Journal of Mental Deficiency Research, 25,* 33–48.

Mithaug, D. E., & Mar, D. K. (1980). The relation between choosing and working prevocational tasks

in two severely retarded young adults. *Journal of Applied Behavior Analysis, 13,* 177–182.
Parsons, M. B., Reid, D. H., Reynolds, J., & Bumgarner, M. (1990). Effects of chosen versus assigned jobs on the work performance of persons with severe handicaps. *Journal of Applied Behavior Analysis, 23,* 253–258.
Peck, S. M., Wacker, D. P., Berg, W. K., Cooper, L. J., Brown, K. A., Richman, D., McComas, J., Frischmeyer, P., & Millard, T. (1996). Choice-making treatment of young children's problem behavior. *Journal of Applied Behavior Analysis, 29,* 263–290.
Saunders, K. J., & Spradlin, J. E. (1989). Conditional discrimination in mentally retarded adults: The effects of training the component simple discriminations. *Journal of the Experimental Analysis of Behavior, 52,* 1–12.
Sidman, M. (1960). *Tactics of scientific research: Evaluating experimental data in psychology*. New York: Basic Books.
Smith, R. G., Iwata, B. A., & Shore, B. A. (1995). Effects of subject- versus experimenter-selected reinforcers on the behavior of individuals with profound developmental disabilities. *Journal of Applied Behavior Analysis, 28,* 61–72.
Soraci, S. A., Jr., Deckner, C. W., Baumeister, A. A., & Carlin, M. T. (1990). Attentional functioning and relational learning. *American Journal on Mental Retardation, 95,* 304–315.
Vaughn, B. J., & Horner, R. H. (1997). Identifying instructional tasks that occasion problem behaviors and assessing the effects of student versus teacher choice among these tasks. *Journal of Applied Behavior Analysis, 30,* 299–312.
Windsor, J., Piche, L. M., & Locke, P. A. (1994). Preference testing: A comparison of two presentation methods. *Research in Developmental Disabilities, 15,* 439–455.
Zygmont, D. M., Lazar, R. M., Dube, W. V., & McIlvane, W. J. (1992). Teaching arbitrary matching via sample stimulus-control shaping to young children and mentally retarded individuals: A methodological note. *Journal of the Experimental Analysis of Behavior, 57,* 109–117.

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STUDY QUESTIONS

1. What are some potential benefits of allowing individuals to choose reinforcers on a within-session basis (i.e., during training sessions)?

2. What was the purpose of the study?

3. Describe the experimental task and the reinforcement schedules used during the study. Also, what were the purposes of the color discrimination task and the clicker?

4. Describe the two choice conditions and how these conditions were presented under the single- and concurrent-operants arrangements.

5. What effects did the above conditions have on response rates?

6. What explanations are offered by the authors to account for the results? Which of these explanations appears to be most strongly supported by the data presented?

7. According to the authors, what factors may have contributed to the differential sensitivity of the single- and concurrent-operants arrangements?

8. Describe some additional experimental manipulation that might clarify the results obtained in the study.

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